Ontario Geological Survey

Northern Ontario Engineering Geology Terrain Study 59

SCHREIBER AREA

(NTS 42D/NW)

District of Thunder Bay

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ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES
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by

John F. Gartner

1979

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MAP
(accompanying report)

Map 5092 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Schreiber (NTS 42D/NW). Scale 1:100 000.

Northern Ontario

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John F. Gartner[1]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the Schreiber area, District of Thunder Bay. The area, which covers NTS block 42D/NW, lies between Latitudes 48°30′N and 49°00′N and Longitudes 87°00′W and 88°00′W. This report forms part of a series of publications which provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide a guide for engineering and resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5092, accompanying this report).

Interpretation of existing black and white aerial photographs, at scales of approximately 1:54 000, was the primary method of obtaining this

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terrain information. The interpretation was checked with published and unpublished literature which documented previous field visits and observations. During the summer of 1978, roads in the area were traversed and observed terrain conditions recorded, as further verification of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further information on the mapping techniques, legend format, and possible uses of this information is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard, and Roed, in preparation), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING:

2.1 BEDROCK:

Massive and rugged bedrock hills dominate the landscape along the north shore of Lake Superior. Relief in excess of 150 m is common, and hillside slopes are steep and complex.

The dominant bedrock terrain is composed mainly of felsic igneous rocks of early Precambrian age. Two metavolcanic-metasedimentary belts are present in the area. One extends northeast from Schreiber while the other occupies the northern margin of the area from Winston Lake eastwards to Owl Lake. Occurrences of gold, silver, and base metals are found in both belts (Carter *et al.* 1973). In the northwest corner of the area, between the Cypress and Jackpine Rivers, diabase sheets form caprocks over Late Precambrian sedimentary rocks, producing cuesta-like landforms. A large area of slopewash overlying glacial till (tCW(tMG/R)) occupies the slope below a cuesta-like escarpment west of the Cypress River. This landform contains minor talus deposits, and any development in this area should be cognizant of these conditions. Ignace Island is underlain mainly by basaltic volcanic rocks of Late Precambrian age.

The western portions of both metavolcanic-metasedimentary belts have a high mineral potential rating, particularly for the occurrence of gold-

silver, base metals, and rare earths. The remainder of the area has medium mineral potential, although gold-silver and copper molybdenum mineralization may occur marginal to some granite bodies (Springer 1978).

2.2 QUATERNARY:

Ground moraine till forms a discontinuous veneer over the bedrock, but nowhere is it of significant thickness to form the dominant terrain unit. In fact, much of the bedrock is bare, having been eroded by the wave action of glacial Lake Minong. This glacial lake reached an average elevation of about 290 m above sea level.

Glacial meltwaters drained down the major river valleys (i.e. the Jackpine, Cypress, Gravel, Pays Plat and Aguasabon Rivers) into the glacial lakes which occupied the Lake Superior basin. Deposits of sand and gravel fill these valleys. Near the shore of the present Lake Superior, deltas were formed at the mouths of the Cypress, Gravel, Pays Plat, White Sand and Aguasabon Rivers. Wave cut terraces are a good illustration of the action of the ancient lakes on these sediments. Most of the offshore islands have examples of small raised beaches, a further example of glaciolacustrine processes.

Records from drill holes put down within these deltas show deposits of sand, silty sand, and some sand and gravel overlying varved silt and clay. This suggests inundation by glacial lakes at least part way up some of these valleys.

A lacustrine delta is presently being formed at the mouth of the Gravel River, the landform being quite evident on the airphotos.

3.0 ENGINEERING TERRAIN UNITS:

3.1 BEDROCK:

3.1.1 Description:

Bedrock knobs (RN) are the dominant terrain unit in the map-area. Overburden is less than 1 m thick, and many of the rock knobs are bare. In

some cases, the overburden becomes thicker on the flanks of and between the bedrock hills. Relief is high, often greater than 150 m, and slopes are steep and complex. This combination of conditions produces some of the most spectacular scenery in Ontario. A typical symbol depicting this terrain unit is:

$$\frac{RN(tMG/R)}{Hj\text{-}D}$$

3.1.2 Significance:

RESOURCES: Portions of the rock can be used for crushed stone purposes, but detailed evaluations of suitability for aggregate use would be required. Ground water resources within the bedrock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has only fair potential for ground water supplies. The natural rugged beauty of the landscape and the great number of scenic vantage points can be considered a resource of this area.

GENERAL CONSTRUCTION: The major constraint in terms of construction and development is the presence of massive, irregular, and complexly sloping bedrock outcrops. Because of the general lack of overburden, almost any type of development will require blasting and rock grading. This will increase construction costs and necessitate the use of rock fills or the importation of suitable soil fills. Foundation conditions should be excellent on the bedrock, but the steep and complex slopes can present problems in the siting of structures. Route alignments are difficult to locate, and extensive blasting and filling will likely be necessary to maintain design criteria grades.

The shallow drift cover, combined with the massive and complex bedrock outcrops, will make development activities difficult and expensive. Also, management of the land for any development would be complex. The variable and steep rock slopes covered with only a veneer of drift will be sensitive to surface erosion, especially if the land is cleared of vegetation.

WASTE DISPOSAL: The bedrock terrain is generally unsuitable for the disposal of waste, whether it be garbage, septic tank effluent, or industrial liquid waste. Development of lagoons or tile fields would require

extensive grading of rock materials and importation of soil fill. Fractures in the bedrock could act as conduits for migration of effluents, and impact on surface drainage courses could be significant.

3.2 GLACIOLACUSTRINE LANDFORMS:

3.2.1 Description:

Glaciolacustrine deltas (LD) have been mapped at five locations along the shoreline of Lake Superior. Because of the changing geological environments during the past 10,000 years, the stratigraphy and form of these deltaic deposits is complex. Thick strata of glaciolacustrine clay and silt occurring at depth provide evidence of the deep water conditions that existed during previous glacial lake stages. Nearer surface, there are bedded deposits of sand representing deltaic environments. The existence of surficial gravel and sand materials suggests glaciofluvial influences. Finally, the presence of terraces, wave cut scarps, and beach materials indicates the influence of near-shore glaciolacustrine processes.

Each of the deltaic deposits is described below.

CYPRESS BAY: Sandy deltaic deposits, which flank the Cypress River at its mouth, have been mapped as:

$$\frac{\text{sLD}}{\text{Lp-Dh}}$$

These deposits are dry on surface, but a high water table is suspected. Boreholes sunk at the bridge crossing indicate about 6 m of sand and gravel, underlain by more than 21 m of varved silt and clay. A 2 m thick gravel horizon overlies bedrock at about 29 m below ground surface.

GRAVEL RIVER-MOUNTAIN BAY: The Gravel River has downcut through thick deposits of sand and gravelly sand; steep, actively eroding banks are visible from Highway 17. Boreholes for a bridge structure over the Gravel River indicate the following stratigraphy:

0 to 6.1 m – medium sand and silty sand
6.1 m to 12.2 m – grey varved silty clay
12.2 m to 36.6 m – light grey silt
below 36.6 m – bedrock (red slate)

South of the river, the materials comprising the deposit appear to be coarser, as indicated by the symbol:

$$\frac{\text{sgLD}}{\text{Lpt-D}}$$

North of the river, the symbol

$$\frac{\text{sLD}}{\text{Lpt-D}}$$

indicates that the material is predominantly sand. A delta is presently being formed at the mouth of the Gravel River.

PAYS PLAT BAY: The material at the mouth of the river has been mapped as a silty sand delta:

$$\frac{\text{smLD(sAP)}}{\text{Lp-D(M)}}$$

Boreholes for a bridge structure indicate more than 15 m of stratified sand, silt, and varved clay.

SELIM: This deltaic deposit of gravelly sand has been modified by glacial lake action, resulting in the formation of beaches atop the delta, as indicated by the symbol:

$$\frac{\text{sgLD(sgLB)}}{\text{Lst-D}}$$

TERRACE BAY: This deltaic feature is composed of fine to medium sand and is mapped as:

$$\frac{\text{sLD}}{\text{Lp-D}}$$

A water well log drilled east of the pulp mill indicates 27.4 m of medium sand overlying 11.3 m of clay, with bedrock intersected at 38.7 m. Wave action from lower glacial lake stages has cut a series of well-defined terraces from the top of the delta down to the present lake level in the vicinity of the town.

3.2.2 Significance:

RESOURCES: The predominant material found in the deltas is sand, with gravel being of secondary importance. As such, the deposits are not rated as top priority aggregate sources. However, a number of pits have been opened, and the landforms are still worthy of careful examination if aggregate materials are required.

Most of these deposits are very deep and they have potential as aquifers for the supply of ground water. The materials grade to silt and clay at depth, but gravel lenses over the bedrock could yield adequate supplies. Detailed investigations would be necessary to confirm any potential water supplies.

GENERAL CONSTRUCTION: Existing boreholes through these deposits indicate the existence of varved clay and silt at depth, with bedrock often being 30 m or more below surface. Foundation conditions are less than ideal because of the underlying clay and silt. Piled foundations may be necessary for heavy structures, and geotechnical investigations are mandatory for any type of development. Surface materials are suitable for reuse, and shallow excavations should encounter minimal problems. Local high water tables may necessitate dewatering in excavations, but this is expected to be of minor concern. The Gravel River has cut a deep valley through sand deposits, with steep, actively eroding slopes along its banks. Construction near the top of these slopes could be hazardous.

WASTE DISPOSAL: Septic systems, if properly designed, should encounter few problems in these landforms. Lagoons, however, would have to be lined with manufactured or imported impermeable materials, and landfill operations could cause contamination of ground water resources. The major concern regarding waste disposal is the possible movement of contaminants in an unconfined aquifer environment. Thus, detailed hydrogeologic investigations are necessary to determine ground water flow conditions and the relationship between ground and surface water.

3.3 GLACIOFLUVIAL LANDFORMS:

3.3.1 Description:

Outwash deposits (GO) fill most of the major river valleys. They consist of gravelly sand and sandy gravel deposited by the glacial meltwaters

which flowed down these valleys, discharging material into the deltas previously described. The deposits are generally dry and often terraced.

Typical terrain unit symbols are:

$$\frac{\text{sGO}}{\text{Lp-D}} \qquad \frac{\text{sgGO(RN)}}{\text{Lun-M}} \qquad \frac{\text{gsGO}}{\text{Lt-D}}$$

A spectacular erosion face on the north bank of the Jackpine River, where it crosses Highway 17, shows more than 50 m of stratified sandy gravel and gravelly sand. Drill holes sunk by the Ministry of Transportation and Communications indicate that there is at least another 16 m of medium to coarse gravel below the road surface. Boulders up to 1 m in diameter were intersected.

A ridge of outwash material separates Hays Lake to the north from Terrace Bay to the south. The origin of this landform is somewhat in doubt. Zoltai (1967) called it an end moraine and Farrand (1960) indicated that it is not a beach form. Field observations by the author showed that the material consists of coarse to medium sand, with abundant stones and cobbles. All of the clasts appear to be rounded to semi-rounded, and some modified till was seen. It appears that the deposit is ice-contact in origin and has subsequently been modified by glaciofluvial processes and by lake action. The symbol depicting this terrain unit is:

$$\frac{\text{sgbGO}}{\text{Lu-D}}$$

3.3.2 Significance:

RESOURCES: There is potential for the discovery of commercial sand and gravel deposits within these outwash landforms (GO). Coarse material occurs along the upper reaches of the Aguasabon River; access is provided by a forest road which follows the river valley. Potential also exists along the Jackpine and Gravel Rivers, although access along the valley of the latter could present problems.

Ground water resources might be present in the deeper outwash landforms, but specific sites would have to be assessed in detail.

GENERAL CONSTRUCTION: The outwash deposits are generally suitable for most types of construction activities. Constraints, where they occur, are associated with 1) grading where the overburden is locally bouldery, 2) bedrock excavations where rock knobs (RN) are a subordinate landform, and 3) stability in areas where rivers have cut down into the outwash (e.g. on the Jackpine River) and in areas of steeply terraced outwash.

WASTE DISPOSAL: Normal septic systems should function satisfactorily within these landforms, but determination of ground water levels and depth to rock is essential.

The outwash deposits which occur in the major river valleys are not particularly suitable for the disposal of solid or liquid industrial wastes. The overburden is permeable and there is the likelihood of direct connection between ground water and surface drainage. Thus, the potential for contaminant migration is high.

3.4 ALLUVIAL LANDFORMS:

3.4.1 Description:

Alluvial plains (AP) can be found adjacent to most rivers and drainage channels in the map-area. In many cases, they have been mapped as part of an outwash deposit. An example is the terrain unit:

$$\frac{\text{sgGO(gAP)}}{\text{Lp-D}}$$

found in the valley of the Aguasabon River. The alluvium is very coarse and cobbles and stones are evident on the river bottom and in the banks along much of this river.

The Gravel River has cut a distinct channel through the outwash and deltaic sediments. Classic meander patterns, oxbows, and steep eroded banks are common along this valley.

3.4.2 Significance:

Development within any of the alluvial plains is not advised. There is the risk of flooding, ground conditions can be poor for construction, and ground water levels are high. These river valleys act as major drainage courses for the area north of Lake Superior, and any impediment to this flow could have serious effects, both downstream and upstream.

3.5 ORGANIC LANDFORMS:

3.5.1 Description:

Organic terrain (OT) is not particularly widespread within the map-area. Small pockets are associated with the rock terrain, but these are of little significance. Larger deposits are associated with the thicker overburden along the northern boundary of the area.

In many cases, the organic peat forms a veneer of varying thickness over outwash sand and/or ground moraine till. Water tables are at or above surface and the organic materials are soft and compressible. Typical terrain unit symbols are:

$$\frac{\text{pOT}}{\text{Lp-w}} \qquad \frac{\text{pOT(tMG/RN)}}{\text{Lp-W}} \qquad \frac{\text{pOT(sGO)}}{\text{Lp-W}} \qquad \frac{\text{pOT(msAP)}}{\text{Lp-W(M)}}$$

3.5.2 Significance:

The organic landforms within this map-area should be avoided by human activities. They do not constitute a resource, other than as a habitat for wildlife or as a mechanism for surface flow augmentation. Because the swamps are not extensive and the peat is suspected to form only a thin, variable layer over mineral soil, the organic terrain is of little economic significance.

Construction in the swamps would have to contend with soft ground conditions, high water tables, and poor access. They are poor locations for waste disposal sites.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

The preceeding section described the characteristics of the major landform types and the engineering and resource significance of these units. Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map units. Site-specific work is necessary to better define actual ground conditions. Also, it must be realized that there are a number of conditions, such as drainage and slope, which are not shown on the table, but which may affect the engineering significance of the various terrain units.

TABLE 1 SUMMARY OF ENGINEERING SIGNIFICANCE.

		BEDROCK	GLACIOLACUSTRINE	GLACIOFLUVIAL	ALLUVIAL
		RN	sLD	sgGO	AP
RESOURCE POTENTIAL	Sand & Gravel	Poor	Fair	Excellent	Poor
	Ground Water	Poor	Good	Fair	Poor
LIGHT CONSTRUCTION CONDITIONS	Excavation	Blasting	Good	Good	Poor
	Foundation	Excellent	Fair	Good	Poor
	Grading	Difficult	Good	Good	Poor
	Material Re-Use	Rock Fill	Good	Excellent	Poor
WASTE DISPOSAL	Septic	Very Poor	Good	Good	Very Poor
	Landfill	Poor	Fair	Poor	Very Poor
	Lagoons	Very Poor	Fair	Poor	Very Poor

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42D-1	Gravel River Bridge
42D-2	Little Gravel River
42D-5	Jackpine River Crossing
42D-6	Rossport Overpass Embankment, C.P.R. Overpass
42D-8	Pays Plat Creek
42D-9	Cypress River Crossing

Strip Map Index, Materials and Testing Division Contract No.

78-544	Various
76-06	Highway 17
69-77	Highway 17
69-173	Highway 17

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